5p

X63 13197

UNPUBLISHED PRELIMINARY DATA

RF Project 1492
Report No. 1

CODE
~~2A~~ 2d

SEMI-ANNUAL

REPORT

by

THE OHIO STATE UNIVERSITY
RESEARCH FOUNDATION

1314 KINNEAR ROAD
COLUMBUS 12, OHIO

To: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington 25, D. C.
Grant No. NsG-295-62

On: BIOLOGICAL EFFECTS OF PROLONGED EXPOSURE OF SMALL MAMMALS TO CLOSED GASEOUS ENVIRONMENT

For the period: 1 September 1962 - 28 February 1963

Submitted by: Dr. E. P. Hiatt
Department of Physiology

Date: April 1963

BIOLOGICAL EFFECTS OF PROLONGED EXPOSURE OF SMALL MAMMALS TO CLOSED GASEOUS ENVIRONMENT

BACKGROUND

This project utilizes the experience and equipment developed in a contract with the Office of Naval Research which expired August 1962. Under this contract a facility was constructed to study the effect of continuous exposure of young rats to a nitrogen-free atmosphere consisting of pure oxygen at a reduced pressure. During a 27-day exposure these animals showed no difference in growth rate, O_2 consumption, food and water intake or behavior, from their controls in a similar closed environment but breathing air. This work is summarized in a final report to ONR and in two papers which have been submitted to the Journal of Applied Physiology for publication.

SUMMARY OF PROGRESS

During the first six months since this NASA research grant was activated on September 1, 1962, we have assembled a research team, improved our facilities and opened up several interesting avenues of investigation.

A. Staff

1. Dr. E. P. Hiatt, M.D., Ph.D., is supervisor of the project and is paid for one quarter of his time.

2. Dr. Harold S. Weiss, Ph.D., Associate Professor of Physiology at Rutgers University is on leave from that post to spend full time as research associate on our project.

3. Dr. Ronald A. Wright, D.V.M., formerly an Air Force pilot, this young veterinarian is half-time on the project as a research associate. He is working toward a Masters degree in Physiology in the remainder of his time.

4. Mr. Charles Wharton, a full time research assistant.

5. Mr. Henry Strawser, an electronic technician, working one-fifth of his time on the project.

In addition there are a number of other individuals, mostly research fellows and graduate students who are not paid by the project but who utilize our laboratory and facilities for various research projects related to the general subject of the physiology of unusual gaseous environments. Some of their names will be mentioned in the list of these projects below.

B. Projects

1. Rats in a Helium - Oxygen Atmosphere

Dr. John Tarsitano, a post-doctoral fellow in Dental Surgery working on a Masters degree in Physiology, studied young rats in a nitrogen free environment achieved by substituting helium for the nitrogen in air at one atmosphere total pressure. The animals were studied in paired environmental chambers, (one containing air, the other 79% He-21% O_2) with glove ports so that the animals could be weighed and supplied without altering the environment. In six days of exposure the 12 animals in the He-O_2 atmosphere grew at the same rate but drank more water, excreted more urine and had a higher rate of oxygen consumption than the control animals in air. It was felt that these effects were largely due to a greater rate of heat loss by convection. Because of some technical difficulties we feel that this experiment should be confirmed in another longer experiment before it is published.

2. Development of Chick Embryos in Eggs Incubated in Atmospheres Lacking in Nitrogen

It has been reported by Shannon Allen that chick embroys will not develop to the four-day stage in atmospheres lacking in N_2 whether this is achieved by substituting helium for nitrogen or by incubating the eggs in pure oxygen at reduced pressure. (Abstracts in The Physiologist, Vol. 4, Aug. 1961, and Vol. 5, Aug. 1962). If true, this would be an important indication that nitrogen is not the inert ingredient of the atmosphere for vertebrate life that it is supposed to be. However, our experiments indicate that it is not true. We have repeatedly shown that fertilized chicken eggs develop normally to the four-day stage when incubated in helium and oxygen atmospheres and we have recently carried some through to hatching.

We also have an experiment indicating that such embryos will develop in atmospheres consisting almost entirely of oxygen at reduced pressures but because we had a break in our control of this environment this impression remains to be confirmed.

We are carrying out experiments to determine whether chick embryos incubated in nitrogen-free atmospheres have any change in their rate of oxygen consumption or in their vulnerability to X-ray exposure but these studies are not yet advanced enough to draw any conclusions.

3. Recovery from the Toxic Effects of High Pressure Oxygen

Dr. John Durfey, M.D., has a research fellowship to work with us on the toxicity of pure oxygen environments at one atmosphere of pressure. Working with mice, he will study the reversibility of the toxic action of oxygen in terms of the amount of time per day such animals can spend in oxygen without cumulative effect. Another way to state this is that he will study how long an animal must recover in air after exposure to one atmosphere of oxygen before it recovers so that it can take another such exposure without suffering serious damage.

4. Effect of Low Oxygen Pressure on Blood Flow to Organs

Miss Phyllis Arscott is working on a Ph.D. thesis studying the effect of reduced oxygen atmospheres (10% O_2 - 90% nitrogen) on blood flow to bone (marrow), kidney, spleen and heart. This is measured by a technique using radioactive rubidium. The experimental animals are rats and the project bears part of the cost of her supplies.

C. Future Plans

It can be seen that we are in an exploratory stage of investigation defining problems which will justify more thorough study. Once we have outlined a promising avenue for investigation we can either work on it as a team or assign it to one of the research fellows or graduate students who work with us.

The chick embryo is a convenient organism to use in screening a variety of gaseous atmospheres for deleterious effect since they do not have to be fed, watered or cleaned up after. They are cheap, easy to handle and a statistically valid number of them can be accommodated in a small space.

We plan to continue the projects mentioned above. In addition, we will employe Dr. Robert Bartels, Ph.D. and Assistant Professor of Physical Education, during the summer quarter of 1963. He has had experience in measuring gas exchange in exercising human subjects and

we propose to examine the oxygen and carbon dioxide exchange in subjects taking standard isometric exercise. These exercises are the type suggested for astronauts in orbit in order to counteract the debilitating effects of prolonged weightlessness.

Investigator _____ Date _____

Supervisor Edwin P Hiatt Date April 12, 1963

For The Ohio State University Research Foundation

Executive Director Orin C. Woolpert Date 4/15/63